

In the Claims:

Please add new claims 32 to 33:

1.(original) A method for making a low-stress or stress-poor single crystal with a hexagonal crystal structure, which has a crystallographic c-axis perpendicular to a [0001] surface, from a melt of a crystal raw material, said method comprising the steps of:

a) dipping a single crystal in said melt so that a solid-liquid phase boundary is formed while keeping the single crystal at a temperature below a melting point of the crystal raw material;

b) withdrawing said single crystal from the melt by drawing upward with an upwardly directed drawing motion along the crystallographic c-axis so that a temperature gradient of at least 30 K/cm is present in the single crystal within 1 cm of the solid-liquid phase boundary in order to grow the single crystal with the hexagonal crystal structure with the crystallographic c-axis; and then

c) subjecting the single crystal produced in step b) to a tempering treatment.

2.(original) The method as defined in claim 1, wherein during the tempering treatment the single crystal is heat-treated at a treatment temperature of at least 1750 K and/or isothermally for a time interval of at least one hour.

3.(original) The method as defined in claim 1, wherein the drawing of the single crystal upward takes place with a drawing speed greater than 40 millimeters per day.

4.(original) The method as defined in claim 1, further comprising cooling down the single crystal from a temperature of more than 1750 K to room temperature and adjusting at least one of an axial temperature gradient and radial temperature gradient to at maximum 4 K/cm during the cooling down.

5.(original) The method as defined in claim 1, wherein during said tempering treatment the single crystal and/or a wafer obtained from the single crystal is heated up to temperatures of at least 1850 K and then cooled down with cooling rate of at maximum 20 K per hour to maintain a maximum permissible temperature gradient of 4 K/cm in an axial and/or radial direction.

6.(original) The method as defined in claim 1, wherein a temperature of the single crystal is changed linearly and/or stepwise during the tempering treatment.

7.(original) The method as defined in claim 1, wherein said tempering treatment comprises a two-step heat treatment and said two-step heat treatment has a first treatment step, in which the single crystal is cooled down at a first cooling rate from a first treatment temperature, and a second treatment step, in which the single crystal or a product made from the single crystal is cooled down at a

second cooling rate that is smaller than the first cooling rate from a second treatment temperature.

8.(original) The method as defined in claim 7, wherein the first cooling rate is less than 50 K per hour.

9.(original) The method as defined in claim 7, wherein the first treatment temperature is 2100 ± 50 K.

10.(original) The method as defined in claim 1, wherein the crystal raw material is corundum, ruby or sapphire.

11.(previously presented) A low-stress or stress-poor hexagonal single crystal obtainable by a method comprising the steps of:

a) dipping a single crystal in a melt of crystal raw material so that a solid-liquid phase boundary is formed while keeping the single crystal at a temperature below a melting point of the crystal raw material, said single crystal consisting of the crystal raw material in single crystal form with a hexagonal crystal structure with a crystallographic c-axis perpendicular to a [0001] surface;

b) withdrawing said single crystal from the melt by drawing upward with an upwardly directed drawing motion along the crystallographic c-axis so that a temperature gradient of at least 30 K/cm is present in the single crystal within

1 cm of the solid-liquid phase boundary in order to grow the single crystal; and then

c) subjecting the single crystal produced in step b) to a tempering treatment.

12.(original) The hexagonal single crystal as defined in claim 11, wherein during the tempering treatment the single crystal is heat-treated at a treatment temperature of at least 1750 K and/or isothermally for a time interval of at least one hour.

13.(original) The hexagonal single crystal as defined in claim 11, wherein the drawing of the single crystal upward takes place with a drawing speed greater than 40 millimeters per day.

14.(original) The hexagonal single crystal as defined in claim 11, wherein the method comprises cooling down the single crystal from a temperature of more than 1750 K to room temperature and adjusting at least one of an axial temperature gradient and radial temperature gradient to at maximum 4 K/cm during the cooling down.

15.(original) The hexagonal single crystal as defined in claim 11, wherein during said tempering treatment the single crystal and/or a wafer obtained from the single crystal is heated up to temperatures of at least 1850 K and then cooled

down with cooling rate of at maximum 20 K per hour to maintain a maximum permissible temperature gradient of 4 K/cm in an axial and/or radial direction.

16.(original) The hexagonal single crystal as defined in claim 11, wherein a temperature of the single crystal is changed linearly and/or stepwise during the tempering treatment.

17.(original) The hexagonal single crystal as defined in claim 11, wherein said tempering treatment comprises a two-step heat treatment and said two-step heat treatment has a first treatment step, in which the single crystal is cooled down at a first cooling rate from a first treatment temperature, and a second treatment step, in which the single crystal or a product made from the single crystal is cooled down at a second cooling rate that is smaller than the first cooling rate from a second treatment temperature.

18.(original) The hexagonal single crystal as defined in claim 17, wherein the first cooling rate is less than 50 K per hour.

19.(original) The hexagonal single crystal as defined in claim 17, wherein the first treatment temperature is 2100 ± 50 K.

20.(original) The hexagonal single crystal as defined in claim 11, wherein the crystal raw material is corundum, ruby or sapphire.

21.(previously presented) A semiconductor element comprising a hexagonal single crystal, said hexagonal single crystal being obtainable by a method comprising the steps of:

a) dipping a single crystal in a melt of crystal raw material so that a solid-liquid phase boundary is formed while keeping the single crystal at a temperature below a melting point of the crystal raw material, said single crystal consisting of the crystal raw material in single crystal form with a hexagonal crystal structure with a crystallographic c-axis perpendicular to a [0001] surface;

b) withdrawing said single crystal from the melt by drawing upward with an upwardly directed drawing motion along the crystallographic c-axis so that a temperature gradient of at least 30 K/cm is present in the single crystal within 1 cm of the solid-liquid phase boundary in order to grow the single crystal; and then

c) subjecting the single crystal produced in step b) to a tempering treatment.

22.(original) The semiconductor element as defined in claim 21, wherein the crystal raw material is sapphire and further comprising a gallium nitride layer applied to a surface of said single crystal.

23.(original) The semiconductor element as defined in claim 21, wherein the crystal raw material is sapphire and further comprising a layer applied to a

surface of said single crystal, said layer comprising at least one coating material selected from the group consisting of GaN, AlN, InGaN and InGaAl.

24.(original) The semiconductor element as defined in claim 21, wherein during the tempering treatment the single crystal is heat-treated at a treatment temperature of at least 1750 K and/or isothermally for a time interval of at least one hour.

25.(original) The semiconductor element as defined in claim 21, wherein the drawing of the single crystal upward takes place with a drawing speed greater than 40 millimeters per day.

26.(original) The semiconductor element as defined in claim 21, wherein the method comprises cooling down the single crystal from a temperature of more than 1750 K to room temperature and adjusting at least one of an axial temperature gradient and radial temperature gradient to at maximum 4 K/cm during the cooling down.

27.(original) The semiconductor element as defined in claim 21, wherein during said tempering treatment the single crystal and/or a wafer obtained from the single crystal is heated to temperatures of at least 1850 K and then cooled down with cooling rate of at maximum 20 K per hour to maintain a maximum permissible temperature gradient of 4 K/cm in an axial and/or radial direction.

28.(original) The semiconductor element as defined in claim 21, wherein a temperature of the single crystal is changed linearly and/or stepwise during the tempering treatment.

29.(original) The semiconductor element as defined in claim 21, wherein said tempering treatment comprises a two-step heat treatment and said two-step heat treatment has a first treatment step, in which the single crystal is cooled down at a first cooling rate from a first treatment temperature, and a second treatment step, in which the single crystal or a product made from the single crystal is cooled down at a second cooling rate that is smaller than the first cooling rate from a second treatment temperature.

30.(original) The semiconductor element as defined in claim 29, wherein the first cooling rate is less than 50 K per hour.

31.(original) The semiconductor element as defined in claim 29, wherein the first treatment temperature is 2100 ± 50 K.

32.(new) A method of growing a low-stress or stress-poor single crystal with a hexagonal crystal structure, which has a crystallographic c-axis perpendicular to a [0001] surface, said method comprising the steps of:

a) providing a melt of a crystal raw material consisting of aluminum oxide;

b) dipping a single crystal into said melt, said single crystal consisting of corundum with a hexagonal crystal structure with a crystallographic c-axis perpendicular to a [0001] surface, so that a solid-liquid phase boundary is formed while keeping the single crystal at a temperature below a melting point of the crystal raw material;

c) withdrawing said single crystal with said hexagonal crystal structure from the melt by drawing upward with an upwardly directed drawing motion along the crystallographic c-axis at a drawing speed of 30 to 150 mm/day so that a temperature gradient of at least 30 K/cm is present in the single crystal within 1 cm of the solid-liquid phase boundary in order to grow the single crystal with the hexagonal crystal structure with said crystallographic c-axis; and then

d) tempering said single crystal produced in step c) by heat-treating at a treatment temperature of at least 1850 K for at least one hour; and

e) cooling down said single crystal with a cooling rate of at maximum 50 K/hr from said treatment temperature while adjusting at least one of an axial temperature gradient and radial temperature gradient to at maximum 4 K/cm during the cooling down;

so that said low-stress or stress-poor single crystal grown in a direction of said crystallographic c-axis has lower stress values than corundum single crystals grown in an m-direction or in an r-direction from said melt.

33.(new) A low-stress or stress-poor single crystal of corundum grown by a method comprising the steps of:

a) providing a melt of a crystal raw material consisting of aluminum oxide;

b) dipping a single crystal into said melt, said single crystal consisting of corundum with a hexagonal crystal structure with a crystallographic c-axis perpendicular to a [0001] surface, so that a solid-liquid phase boundary is formed while keeping the single crystal at a temperature below a melting point of the crystal raw material;

c) withdrawing said single crystal from the melt by drawing upward with an upwardly directed drawing motion along the crystallographic c-axis at a drawing speed of 30 to 150 mm/day so that a temperature gradient of at least 30 K/cm is present in the single crystal within 1 cm of the solid-liquid phase boundary in order to grow the single crystal with the hexagonal crystal structure with said crystallographic c-axis; and then

d) tempering said single crystal produced in step c) by heat-treating at a treatment temperature of at least 1850 K for at least one hour; and

e) cooling down said single crystal with a cooling rate of at maximum 50 K/hr from said treatment temperature while adjusting at least one of an axial temperature gradient and radial temperature gradient to at maximum 4 K/cm during the cooling down;

so that said low-stress or stress-poor hexagonal single crystal of said corundum grown by said method in a direction of said crystallographic c-axis has lower stress values than corresponding corundum single crystals grown in an m-direction or in an r-direction from said melt.